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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

ORIGINAL

In the Matter of )

Guidelines for Evaluating the )  
Environmental Effects of )  
Radiofrequency Radiation )

ET Docket No. 93-62

REPLY COMMENTS OF NORTHERN TELECOM

Northern Telecom Inc. ("Northern Telecom") hereby replies to the comments on the proposal to amend and update the guidelines and methods used for evaluating the environmental effects of radiofrequency (RF) radiation from FCC regulated facilities and devices.<sup>1/</sup> Northern Telecom believes that on a number of important issues a consensus has developed. There appears to be universal agreement among the commenters that the amendment of the guidelines should successfully meet as a primary goal the creation of an environment that is safe for all. Northern Telecom thus urges the Commission to move ahead expeditiously with its proposal to update the regulations concerning the potential health effects of radiation, and to do so in a manner that will not unnecessarily retard the utilization, deployment and development of spectrum-based services.

1/ Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, ET Docket No. 93-63, FCC 93-142, released April 8, 1993 ("Notice").

### Low Power Formula

Northern Telecom urged the Commission to extend the low-power exclusion formula to the 2 GHz band that will be used for PCS. Many other commenters advocated such an extrapolation of the formula.<sup>2/</sup> Northern Telecom believes that the record now demonstrates that the low-power formula can safely be extended to 2.2 GHz, which will allow for the timely deployment of PCS equipment. This in turn will ensure that the benefits of PCS, including economic expansion and job creation, will be realized.

In particular, the testing of GSM handsets reflected in Exhibit E of Motorola's comments indicates that the specific absorption rate ("SAR") values for these devices is far below the new proposed ANSI/IEEE limits.<sup>3/</sup> Attachment 1 explains the theoretical basis for Northern Telecom's belief that the low-power exclusion can safely be extended to the 2 GHz band that will be used for PCS.

Northern Telecom also agrees with the comments that support a very low-power formula that would permit devices to be certified even when the radiating structure may be within 2.5 cm of the body.<sup>4/</sup> Through specification of a formula or chart, the

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2/ E.g., Alcatel at p. 3; TIA at p. 10; Telocator at pp. 5-6; PacTel at p. 11; Ericsson at p. 11.

3/ See also ETSI Technical Report, GSM 05.90, January, 1993, suggesting that PCS devices at 1.8 GHz will be safer than equally powered 900 MHz devices.

4/ E.g., E.F. Johnson at p 6; Matsushita at pp. 3 & 7; TIA at p. 10; Motorola at p. 12; Ericsson at p. 10. Northern Telecom believes that it may also be appropriate to develop a very low-  
(continued...)

Commission could establish criteria that would permit deployment of very low-power devices without regard to the anticipated use and whether such use entails the radiating structure being within 2.5 cm of the body. Northern Telecom expects that such devices may be developed for PCS offerings, and a "very low-power" exclusion would greatly simplify the FCC approval of the equipment without compromising health considerations.

### SAR Testing

In its comments in this proceeding, Northern Telecom explained the problem with reliance on SAR testing for PCS devices, including the limited availability of sufficient facilities for such testing.<sup>5/</sup> Northern Telecom also agrees with the comments that observe that SAR testing is not an exact science at this time, and that some refinement of the testing procedures may be necessary before the Commission should require SAR testing by manufacturers. For example, TIA advocates the development of an appropriate SAR measurement standard and a transition period for complying with the new standard, with grandfathering of equipment manufactured before that time.<sup>6/</sup>

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<sup>4/</sup> (...continued)  
power exclusion formula that would allow radiating parts to be brought within 2 mm of the body.

<sup>5/</sup> Northern Telecom Comments at pp. 5-6.

<sup>6/</sup> E.g., TIA at pp. 28-30. Northern Telecom agrees with TIA that it would present too much of a burden on the FCC and manufacturers to have to conduct SAR testing retroactively, and that there is no evidence of any health risk as a result of such "grandfathering."

In light of these potential concerns about SAR testing, Northern Telecom urges the Commission to consider adopting a mathematical model form of SAR testing as an alternative approach. Northern Telecom agrees with Ericsson that the Finite-Difference Time-Domain computational analysis developed by Dr. Om P. Gandhi could be used for SAR calculations.<sup>7/</sup> Moreover, as Matsushita observes, such a method for determining compliance with radiation limits is more consistent with the typical two-year design cycles for new radio equipment.<sup>8/</sup>

Northern Telecom believes that by using conservative values, the Commission could permit a demonstration of compliance by use of mathematical models or a table of values in lieu of SAR testing without creating any health risks. The mathematical limits would yield a level of protection equal to or better than laboratory SAR evaluations, and would be consistent with previous FCC practices. Such an approach will provide manufacturers with clear guidance as they begin to design equipment for new services such as PCS, which is critical given the long design cycle before production of the equipment. If a manufacturer must await production of equipment before physical testing can occur to determine compliance, then costly redesign must take place (with attendant delays) if any errors occur. The increased cost and delay could threaten the mass market potential of PCS and prevent the economic growth and job creation expected to accompany PCS.

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7/ Ericsson at p. 8. Cf., TIA at p. 11 ("it may still be possible to justify exclusion by measuring the SAR or by other analysis").

8/ Matsushita at pp. 10-11.

### ANSI/IEEE Guidelines

Many of the comments support the Commission's proposed use of the 1992 ANSI/IEEE Guidelines as the basis for updating the Commission's regulations. Northern Telecom agrees with such a policy, since those guidelines reflect the most comprehensive and up-to-date information available. Northern Telecom also supports the comments that observed that there are some ambiguities or uncertainties in the ANSI\IEEE Guidelines that will need to evolve over time.<sup>9/</sup> Thus, the Commission should apply the ANSI/IEEE Guidelines as a basis for its regulations, while also recognizing that its Rules cannot be static or inflexible.

In adopting those guidelines, however, Northern Telecom urges the Commission not to apply the requirements retroactively. In its initial comments, Northern Telecom indicated it wanted to study the other comments before determining the best course of action for the Commission to take.<sup>10/</sup> Having reviewed the record, Northern Telecom believes that it would be exceedingly burdensome for both the Commission and the manufacturers if they were required to "re-certify" or re-obtain type approval for equipment. The Commission would quickly be inundated by a blizzard of paper, bringing to a virtual standstill the processes by which new equipment would be authorized. Likewise,

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<sup>9/</sup> See, e.g., Southwestern Bell at pp. 4-6; Sprint at pp. 4-6; Ericsson at pp. 4-7; TIA at pp. 10-11; Ford Motor Company at pp. 3-8.

<sup>10/</sup> Northern Telecom Comments at p. 6.

manufacturers would need to expend significant resources in conducting the tests and creating the paper. Northern Telecom agrees with TIA that such efforts are unnecessary.<sup>11/</sup>

### Categorical Exclusions

Finally, with respect to AT&T's observations regarding categorical exclusions, Northern Telecom agrees with those commenters suggesting that there may be circumstances where higher power devices should not be eligible for categorical exclusions.<sup>12/</sup> However, categorical exclusions can avoid unnecessary testing and reduce the administrative burden on the Commission, while maintaining a conservative measure of protection.<sup>13/</sup> Northern Telecom believes that the proper solution is the adoption of appropriate power limits for PCS, cellular and Part 15 devices to ensure that higher power devices that may create unreasonable risks are restricted in those services, which will allow the Commission to continue the categorical exclusions, rather than elimination of the current categorical exclusions. Thus, Northern Telecom believes that "grandfathering" of the current equipment authorizations is appropriate. Northern Telecom also believes that a categorical exclusion with appropriate power restrictions should apply to

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<sup>11/</sup> TIA at pp. 28-30.

<sup>12/</sup> E.g., TIA at p. 10; E.F. Johnson at p. 7.

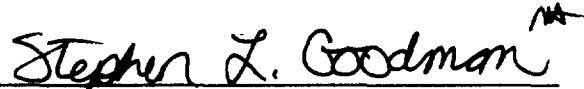
<sup>13/</sup> E.g., McCaw Cellular at p. 6.

PCS, since such a step will allow the service to develop quickly without creating any increased health risks.<sup>14/</sup>

#### CONCLUSION

Northern Telecom urges the Commission to proceed with the adoption of updated regulations based on the ANSI/IEEE Guidelines, taking into account the need to adapt the low-power formula to PCS spectrum. In addition, Northern Telecom urges the Commission to apply the guidelines flexibly and allow an evolutionary implementation, so that the updated regulations do not unreasonably stifle or delay new radio technologies. Such a course of action will benefit the public by providing adequate protection without delaying valuable services such as PCS.

Respectfully Submitted,



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<sup>14/</sup> E.g., TIA at p. 24; Telocator at p. 12.

## Attachment 1

### Extension of the present Low Power Exclusion Formula

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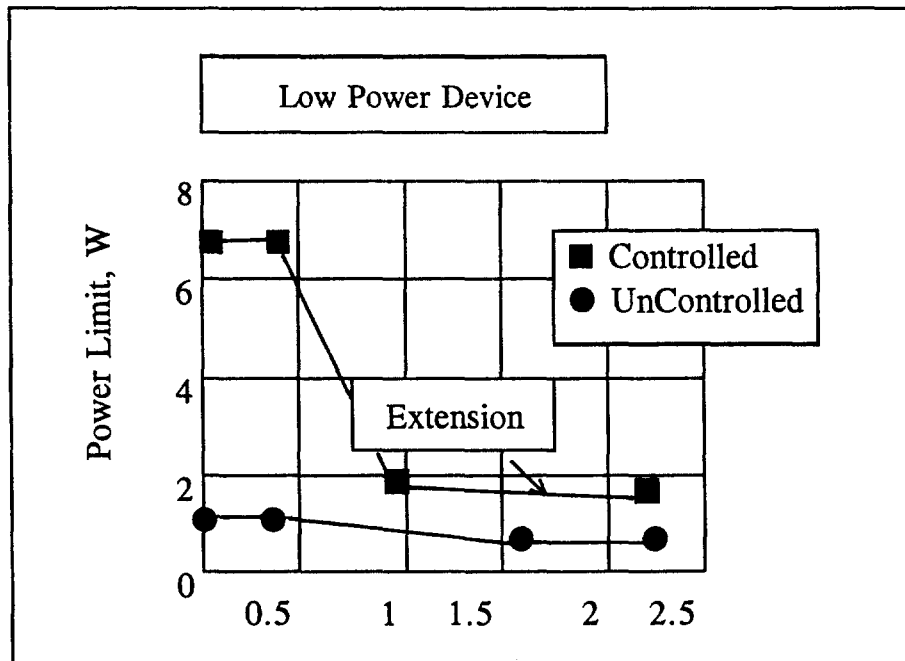
The extension is justifiable within the context of C95.1 based on physical principles. C95.1 is bounded at low frequencies by limits which protect from electric shocks and at high frequencies by tolerable limits of infra-red radiation power densities. Between these two extremes, the general frequency-dependent rule that is applied is that the SAR is proportional to frequency  $\omega$  as

$$SAR = \frac{\sigma \left[ \vec{E} \right]^2}{2\delta} = \frac{\omega \epsilon_\beta \epsilon_1 \left[ \vec{E} \right]^2}{2\delta}$$

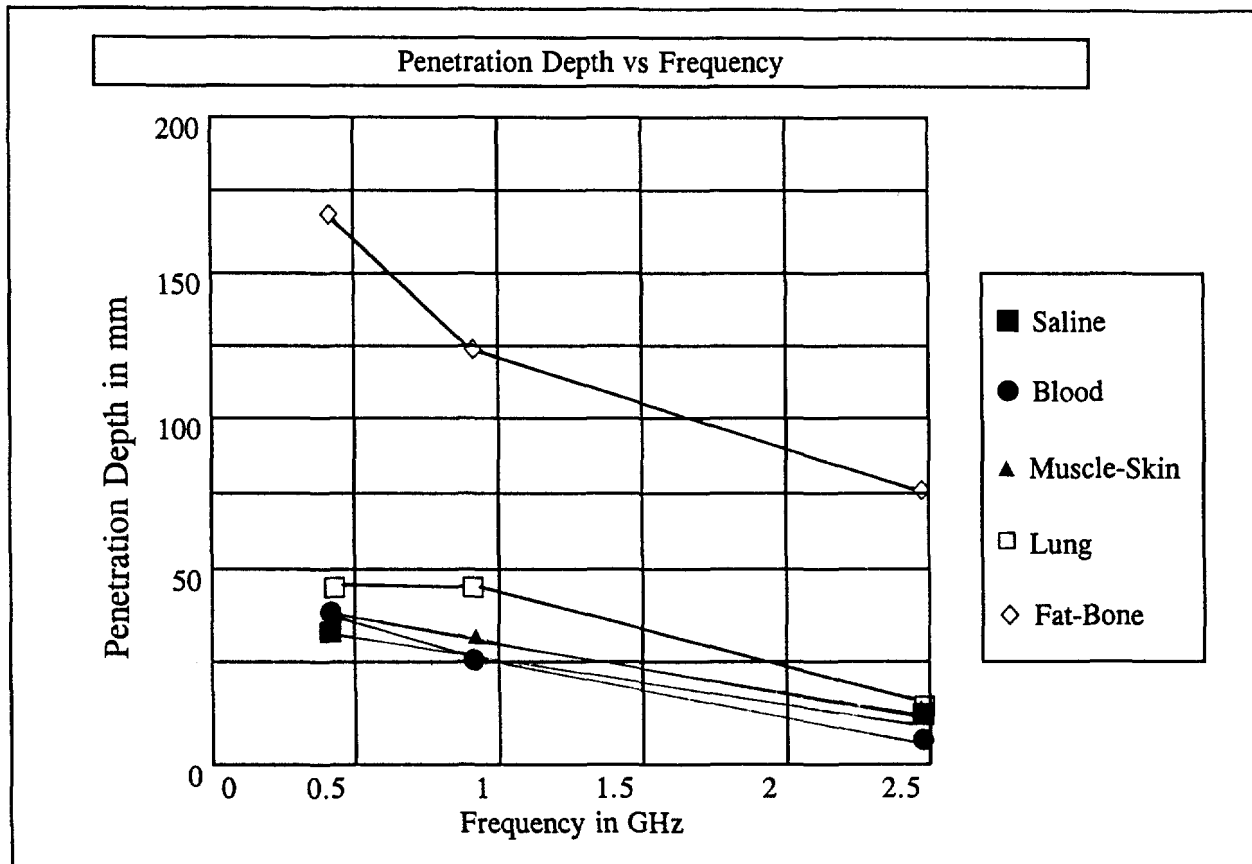
where the SAR is expressed in W/kg,  $\sigma$  is the electrical conductivity in Siemens per meter,  $\omega$  is the angular frequency in radians per second,  $\epsilon_\beta$  is the dielectric constant of free space,  $8.85 \times 10^{-12}$  F/m,  $\epsilon_1$  is the relative dielectric constant, a pure number,  $\delta$  is the density ( $\text{kg/m}^3$ ), and  $E$  is the value of the electric field inside the heated body, in V/m.



The standard actually prescribes a reduction of field levels vs. frequency across the range it covers, with the exception of the body resonance centered at 70 MHz. Specifically, according to the equation above, to maintain a constant SAR over frequency, power, or  $E^2$  should vary as the inverse of frequency (which is prescribed in C95.1 section 4.2.1.1. The extended exclusion rule is pictured below.



Another technical element which contributes to make an extension of the formula conservative is decreased penetration depth of radiation at higher frequencies, as shown below.



Since heat penetrates less into the tissues as frequency increases, there is less possibility of energy being focused deep within the brain by skull scattering, and more and more of it is confined to the skin (until, in the limit case, we have the penetration of depth less than 1 mm. typical of infrared). Although the dead layer of the skin is only 10  $\mu\text{m}$ . thick, which means that living cells are exposed to radiation in all cases, the skin is well adapted to changes in temperature because it is submitted to it very frequently in the natural environment. As more of the energy is confined to the skin, we are reassured that the thermal effects are similar to natural ones, and that the average thermal loading which forms

the basis of the standard is not exceeded. Also, thermal sensors in the skin ensure that subjects cannot be unwittingly exposed.